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(54) Methods for Producing Capsule Units Encapsulating a Flavoring

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Specification

1. Title of the Invention

Methods for Producing Capsule Units Encapsulating a Flavoring

2. Scope of Patent Claim

(1) A method for producing a capsule unit encapsulating a flavoring, whereby a liquid containing a water-soluble divalent metal salt and flavoring component serves as the core and an aqueous alginic acid alkali-metal salt wherein the ratio (M/G ratio) of mannuronic acid (M) and guluronic acid (G) is less than 1 serves as the sheath liquid and the two are made into a gel by an interface reaction with the flavoring component becoming the core and its surface being coated with alginic acid divalent metal salt gel.

(2) A method for producing a capsule unit encapsulating a flavoring, whereby a liquid containing a water-soluble divalent metal salt, a paste substance, and a flavoring component serves as the core and an aqueous alginic acid alkali-metal salt wherein the ratio (M/G ratio) of mannuronic acid (M) and guluronic acid (G) is less than 1.0 serves as the sheath liquid and the two are made into a gel by an interface reaction with the flavoring component becoming the core and its surface being coated by alginic acid divalent metal salt gel.

(3) A method for producing a capsule unit encapsulating a flavoring, whereby a liquid containing a water-soluble divalent metal salt, a flavoring component, and edible oil serves as the core and an aqueous alginic acid alkali-metal salt wherein the ratio (M/G ratio) of mannuronic acid (M) and guluronic acid (G) is less than 1.0 serves as the sheath liquid and the two are made into a gel by an interface reaction with the flavoring component becoming the core and its surface being coated by alginic acid divalent metal salt gel.

(4) The method for producing a capsule unit encapsulating a flavoring in any of claims (1) through (3), wherein the water-soluble divalent metal salt is water-soluble calcium salt.

(5) The method for producing a capsule unit encapsulating a flavoring component in claim (4), wherein the water-soluble calcium salt is calcium gluconate.

(6) The method for producing a capsule unit encapsulating a flavoring component in any one of claims (1) through (5), wherein the flavoring component is seasoning with a high table-salt concentration.

3. Detailed Description of the Invention

Industrial field of the invention

The present invention pertains to a method for producing a capsule unit, wherein a food product flavoring, such as seasoning, spice, an emulsion containing edible oil, etc., is encapsulated in an alginic acid gel capsule. The

edible capsule unit that is obtained can be widely used for the flavoring of food products, toppings, drug products, such as capsule food products, etc.

Prior art

It is known that capsule units and gel spheres (capsule units hereafter) have previously been made by a gelling reaction whereby a core liquid containing a water-soluble divalent metal salt such as calcium chloride and sodium alginate are subjected to an interface reaction.

The ratio of the mannuronic acid (M) and guluronic acid (G) (M/G ratio) structural components of the sodium alginate used to produce this type of capsule unit is generally one or higher. However, there is a disadvantage with capsule units obtained using this type of sodium alginate in that when they are stored in an aqueous table-salt solution, the calcium contained in the capsule unit gel is substituted by sodium and the capsule sheath swells, and its strength deteriorates as well. Moreover, there is a disadvantage in that swelling and deterioration of strength of a capsule unit whose core liquid contains a high concentration of table salt or a seasoning containing table salt similarly occur, leading to destruction of the capsule unit. Consequently, it is technically difficult to store this type of capsule unit in table-salt water or to use a core that contains table salt or a seasoning component containing table salt.

Furthermore, calcium salts used to produce capsule units are almost always calcium chloride or calcium lactate. When calcium chloride is present in the capsule unit, it has a bitter or astringent taste, often greatly compromising the flavor of the capsule unit. Consequently, the method has been disclosed

whereby in order to eliminate the calcium salt that remains in this type of capsule unit and to improve its flavor, the capsule unit that is obtained is rinsed in running water to a flavorless state and then immersed in the desired seasoning liquid (refer to Japanese Patent No. 61[1986]-4509 and Japanese Patent No. 63[1988]-45,774). Moreover, the method has also been presented whereby 30 wt% saccharide is added to the core liquid, the specific gravity is adjusted, and the capsule unit is produced. However, treatment by rinsing under water is performed by this method as well (refer to Japanese Patent No. 63[1988]-45,192). There are disadvantages with these methods in that rinsing under water is performed after the capsule unit has been formed and therefore, there is marked elution of the seasoning components contained in the core liquid during this process. The procedure is complex and cost is high, making [these methods] difficult to use for practical purposes.

Problems to be solved by the invention

The object of the present invention is to solve these disadvantages of alginic acid gel capsule units.

That is, by means of the present invention, it is possible to produce capsule units with excellent salt resistance in which flavoring components with a high table-salt concentration can be encapsulated without swelling or destruction of the capsule unit, even when it is stored immersed in table-salt water.

Furthermore, by means of the present invention, there is no residual bitter or astringent taste, even when the process of rinsing the capsule unit that is

obtained under water is not performed, and therefore the production process can be simplified.

Structure of the invention

The present invention pertains to a method for producing a capsule unit encapsulating a flavoring, whereby a liquid containing a water-soluble divalent metal salt and flavoring component serves as the core and an aqueous alginic acid alkali-metal salt wherein the ratio (M/G ratio) of mannuronic acid (M) and guluronic acid (G) is less than 1 serves as the sheath liquid and the two are made into a gel by an interface reaction with the flavoring component becoming the core and its surface being coated with alginic acid divalent metal salt gel.

Moreover, a paste substance can also be used together with the divalent metal salt in the present invention.

Seasonings such as miso, soy, sauces, ketchup, gravy, ramen, etc., spices such as wasabi, mustard, garlic, ginger, etc., edible oil-containing emulsions, such as dressings, etc., and food products such as jam, cream, beefsteak-plant-flavored plums, bonito-flavored plums, nori, seasoned sea urchin eggs, crab, lobster, lard, etc., can be used as the flavoring components in the present invention. Moreover, it is possible to produce artificial fish egg-like food products by using a core liquid made from edible oil, table salt, salmon extract, gelatin, and xanthan gum in the present invention. These are used either by being dissolved in an aqueous solution or dispersed in paste form together with the water-soluble divalent metal salt.

The water-soluble divalent metal salt can be any [water-soluble divalent metal salt] that is used as a food product. Calcium chloride, calcium lactate, calcium gluconate, hydrates of these compounds, etc., are used.

Although it varies with the type of salt in the core liquid, these are used within a range of 1 to 16%, 1 to 2% in the case of calcium chloride and 3 to 6% in the case of calcium gluconate.

Of these, calcium gluconate is a calcium preparation that is particularly tasteless and odorless in comparison to the other calcium salts and is therefore ideal for use in the present invention. When calcium gluconate is used, the capsule unit is not given a bitter or astringent taste and therefore, the process of rinsing under water is not necessary and the disadvantages attributed to this process of rinsing under water can therefore be eliminated.

Although there are no special restrictions to the type of alginic acid alkali-metal salt that is used as long as it has an M/G ratio of less than 1 and it is used in food products, sodium salt with an M/G ratio within a range of 0.2 to 0.6 is usually used. This type of sodium alginate is known by the brand name of Dachalgin for Bioreactors® (Kibun Food Chemifa), etc., and can be easily obtained. This is used at a ratio of 0.5 to 1% in the sheath liquid.

Moreover, by means of the present invention, it is possible to add to these components a natural paste substance, such as gelatin, xanthan gum, tragacanth gum, agar, and other polysaccharides, etc., or synthetic paste substances such as methylcellulose, etc., as needed and to adjust the viscosity of the core liquid to provide the capsule unit with resiliency and to make the

capsule more appealing or to obtain a capsule unit in the shape of a large sphere. The appropriate amount is 0.5 to 4%. Furthermore, by means of the present invention, it is possible to concomitantly use a seasoning and a coloring, etc.

The reaction between the core liquid and the sheath liquid can be accomplished by dropwise addition of the core liquid in which the water-soluble divalent metal salt and the flavoring component are dissolved or dispersed into the sheath liquid of an aqueous alginic acid alkali-metal salt solution using, for instance, a nozzle, etc., and then setting this product aside for several minutes. Thus, it is possible to produce a capsule unit encapsulating a flavoring component as a result of the gelling that occurs when the alginic acid alkali-metal salt is substituted with alkaline-earth metal salt.

Examples will now be given:

Example 1

A solution of 2 wt% calcium chloride, 2 wt% salmon extract, and 0.5 wt% xanthan gum was prepared and served as the capsule core liquid. A capsule unit was obtained by dropwise addition of the above-mentioned solution to an aqueous solution of 0.5% sodium alginate with an M/G ratio of 0.2 or 0.4 through a nozzle with a diameter of 7 mm. This capsule unit was stored in an aqueous sodium chloride solution prepared to a pre-determined concentration and the capsule film thickness and capsule strength were determined.

By way of comparison, encapsulation was performed as described using as the control 0.5% sodium alginate with an M/G ratio of 1.0.

The results of determinations after three days of storage in an aqueous sodium chloride solution are shown in Table 1 and Table 2.

Table 1

Changes in capsule film thickness with storage for three days in various aqueous sodium chloride solutions

(units mm)

NaCl concentration	M/G ratio 0.2	M/G ratio 0.4	M/G ratio 1.0
NaCl濃度 (%)	M／G比0.2	M／G比0.4	M／G比1.0
1	0.64	0.39	0.74
2	0.59	0.55	0.88
3	0.62	0.58	×
4	0.58	0.51	×
5	0.71	0.59	×
6	0.64	0.56	×
7	0.55	0.57	×
8	0.47	0.58	×
9	0.41	0.57	×
10	0.35	0.47	×

(Note) x: destruction of capsule film

Table 2

Changes in capsule breaking strength when stored for three days in various aqueous sodium chloride solutions

(units g)

NaCl concentration	M/G ratio 0.2	M/G ratio 0.4	M/G ratio 1.0
NaCl濃度（%）	M／G比0.2	M／G比0.4	M／G比1.0
1	19.6	10.7	5.8
2	12.6	10.4	5.3
3	8.2	7.9	×
4	8.7	9.6	×
5	7.1	8.3	×
6	4.7	7.0	×
7	5.9	7.8	×
8	7.7	8.3	×
9	8.1	9.3	×
10	6.2	9.7	×

(Note) x: destruction of capsule film

As is clear from Table 1 and Table 2, when a capsule unit that had been prepared using sodium alginate with an M/G ratio of 1 was stored for three days in an aqueous sodium chloride solution with a concentration of 1 to 10%, there was a reduction in breaking strength and the film thickness increased with swelling, even at a low concentration of 1%. There was a dramatic reduction in breaking strength with the capsule unit being destroyed when the concentration was 3% or higher.

In contrast to this, capsule units that were prepared using sodium alginate with an M/G ratio of 0.2 or 0.4 as in the present invention always

showed a markedly high breaking strength with little swelling of the film and no capsule destruction whatsoever and marked salt resistance when compared to the case of an M/G ratio of 1.0.

Consequently, the capsule unit of the present invention can be stored immersed in salt water, and it can encapsulate a flavoring component with a high table-salt concentration.

Example 2

Five parts by weight of calcium gluconate monohydrate powder for food additives were mixed and dissolved in 95 parts by weight of commercial Worcestershire sauce to serve as the core liquid.

On the other hand, 0.5 part by weight of sodium alginate with an M/G ratio of 0.2 was dissolved in 99.5 parts by weight of water to serve as the sheath liquid.

The above-mentioned core liquid was added dropwise to the above-mentioned sheath liquid through a nozzle with a nozzle diameter of 3 mm and a gelling reaction was performed by setting this aside for approximately three minutes to obtain a stable capsule unit with a spherical shape.

Moreover, the same method was conducted through a nozzle with a nozzle diameter of 7 mm and a stable capsule unit with a spherical shape was similarly obtained.

Furthermore, the same method was performed using a sauce other than Worcestershire sauce (pork sauce, ketchup, etc.) as the flavoring component and a stable capsule unit with a spherical shape was obtained.

Example 3

Forty-three parts by weight of aqueous calcium gluconate monohydrate solution for food additives with a concentration of 16.7% were added and mixed with 100 parts by weight of commercial nori. The nori was dissolved or dispersed to obtain the core liquid.

Then 0.5 part by weight of sodium alginate with an M/G ratio of 0.2 was dissolved in 99.5 parts by weight of water to obtain the sheath liquid.

The above-mentioned core liquid was added dropwise to the above-mentioned sheath liquid through a nozzle with a nozzle diameter of 3 mm and this was reacted for approximately three minutes to obtain a stable capsule unit with a sphere shape.

Example 4

Two parts by weight of pure xanthan gum were added to 100 parts by weight of aqueous calcium gluconate monohydrate for food additives with a concentration of 16.7% to prepare a very viscous aqueous solution. Forty-three parts by weight of this very viscous aqueous solution were added to 100 parts by weight of nori and the nori was mixed with dissolution or dispersion. This served as the core liquid.

Then 0.5 part by weight of sodium alginate with an M/G ratio of 0.2 was dissolved in 99.5 parts by weight of water to obtain the sheath liquid.

The above-mentioned core liquid was added dropwise to the above-mentioned sheath liquid through a nozzle with a nozzle diameter of 7 mm or 9 mm and set aside for three minutes to conduct the reaction. In both cases it was

possible to obtain a capsule unit with a large diameter and high viscoelasticity by addition of xanthan gum.

A stable capsule unit with a spherical shape was obtained by the same method as in Example 4 using commercial beefsteak-plant-flavored plum, mustard, wasabi, etc.

Example 5

Two parts by weight of pure xanthan gum were added to 100 parts by weight of aqueous calcium gluconate monohydrate solution for food additives with a concentration of 16.7% to prepare an aqueous solution of high visco-elasticity. Fifty parts by weight of this aqueous solution were added to 50 parts by weight of commercial mentsuyu and then mixed and dissolved. This served as the core liquid.

Five parts by weight of sodium alginate with an M/G ratio of 0.2 were dissolved in 99.5 parts by weight of water to prepare an aqueous 0.5% sodium alginate solution. This served as the sheath liquid.

The above-mentioned core liquid was added dropwise to a sheath solution through a nozzle with a nozzle diameter of 7 mm and set aside for approximately three minutes to obtain a stable capsule unit with a sphere shape.

Results of the invention

By means of the method of the present invention, it is possible to obtain a capsule unit with excellent salt resistance by using sodium alginate with a low M/G ratio and therefore, it is possible to obtain a capsule unit encapsulating a flavoring component with a high table-salt concentration.

As a result, it is possible to encapsulate soy sauce, miso, mentsuyu, beefsteak-flavored plum, bonito-flavored plum, nori, ramen, sauces, ketchup, gravy, soups, artificial fish eggs, drugs, etc.

Moreover, the problems of leakage and spraying of liquid when a bag is sealed can be solved by using this type of capsule unit in place of small soy sauce packets, etc. used to flavor food products.

Furthermore, it is possible to make small capsule units with good flavor by using calcium gluconate or its hydrates as the water-soluble divalent metal salt of the present invention and reacting this tasteless, odorless substance with sodium alginate having an M/G ratio of less than one.

Thus, the process of rinsing under water to remove calcium salts or immersion in a seasoning liquid that is used with capsule units that have been made with conventional calcium chloride, etc., and sodium alginate having an M/G ratio of 1 or higher becomes unnecessary, and as a result, production can be simplified and performed at a low-cost, from the preparation of the core liquid and the sheath liquid through the series of food production processes, including dropwise addition, encapsulation, recovery, etc.

Consequently, it is possible to encapsulate jams, creams, wasabi, mustard, garlic, ginger, emulsion-containing oils and fat (artificial fish eggs, dressing, etc.), etc.

Applicant: Snow Brand Milk Products
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JAMES GOODELL

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